



APPARATUS AND METHOD FOR MANUFACTURING RECLOSABLE BAGS UTILIZING ZIPPER TAPE MATERIAL

This application is based on, and claims priority to U.S. Patent Application Serial No. 10/039,527, filed November 7, 2001.

FIELD OF INVENTION

The present invention relates to an apparatus and method for sealing zipper tape to a web of flexible film in an airtight manner.

BACKGROUND OF THE INVENTION

The popularity of reclosable zipper fasteners has created a demand for a large number and wide variety of reclosable bag sizes and types. It is commonly known in the art to form a reclosable bag 10 through the addition of a zipper strip 420 to a pair of bag walls 22, 24 in order to form the bag 10 with a reclosable, airtight seal as shown in Figure 7. Transverse application of such zipper strips 420 to a web of flexible film (such as a web of plastic material) is also known in the art.

In many reclosable bag applications, an airtight seal is necessary in order to maintain the freshness and integrity of items stored within the bag 10. However, presently available reclosable bags do not provide or maintain an airtight seal due to air leakage through the ends of the zipper strips, leakage through the seal between the strip and the web, or leakage through the interlocked fastener profiles of the zipper strips themselves. There is thus a need for an apparatus and method for sealing a zipper strip to a web that reduces or eliminates the aforementioned leaks. There is also a need for an apparatus and method for repeatedly and quickly sealing zipper tape to a web to allow for high-speed production of a web with pre-installed zipper-tape to make the production of reclosable bags commercially viable.

Commonly known methods of construction and seal formation often cause inaccurate, commercially unacceptable seals that cannot be produced on an economically practical scale. Commonly known zipper strip formation methods require multiple sealing devices, precise machinery or extensive retooling to alter the size and type of reclosable fastener. Examples of such devices and methods are described in United States Patent Nos. 5,601,368 (Bodolay), 3,847,711 (Howard), 5,461,845 (Yeager), 4,241,865 (Ferrell), 4,335,817 (Bahr), 4,909,017 (McMahon) and 5,024,537 (Tilman). None of the foregoing devices and methods satisfy the need for a multi-purpose reclosable zipper strip that can be accurately and economically sealed in an airtight manner to a web of flexible film.

BRIEF SUMMARY OF THE INVENTION

The present invention overcomes the shortcomings of the foregoing prior art devices and meets the afore-mentioned needs by providing an apparatus and method for accurately sealing a multi-purpose reclosable fastener zipper strip to a web of flexible film in an airtight manner. Moreover, the inventive apparatus and method is capable of repeatedly performing the steps necessary to seal the reclosable fastener zipper strip to the web of flexible material while providing high manufacturing throughput and low cycle times.

Generally, the apparatus and method utilize a reclosable fastener zipper strip having airtight splotch seals fused in series along desired lengths of the reclosable fastener zipper strip. The reclosable fastener zipper strip is dispensed through a feeding mechanism and, when an optical sensor detects one of the splotch seal portions of the reclosable fastener zipper strip, a desired length of the reclosable fastener zipper strip is advanced over an elevator platform. A knife is then signaled to descend and sever the advanced portion of the reclosable fastener zipper strip, which is thus deposited onto the elevator platform.

As the selected portion of the reclosable fastener zipper strip is being positioned and deposited onto the elevator, the web of flexible film is being positioned above the platform. A sealing head is then positioned over the web of flexible film, while at the same time the elevator platform is driven upwardly so that the reclosable fastener zipper strip portion positioned thereon comes into contact with the web of flexible film. The heat passing through the web of flexible film from the sealing head is sufficient to seal the peripheral portions of the reclosable fastener zipper strip section to the web of flexible film, thereby creating an airtight seal between the reclosable fastener zipper strip portion and the web of flexible film.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a front perspective view of a preferred embodiment of the apparatus of invention for sealing a reclosable fastener zipper strip to a web of flexible film;

Figure 2 is a partial front perspective view of the apparatus of Figure 1 showing a pneumatically actuated elevator for placing the reclosable fastener zipper strip of the present invention against the web of flexible film;

Figure 3 is a partial front perspective view of the apparatus of Figure 1 showing the pneumatically activated elevator of Figure 2 having an opening in the center thereof for reception of a sealing head from above the web of flexible film;

Figure 4 is a top perspective view of a sealing head and perforation die positioned above the web of flexible film, with the sealing head positioned to the side of the elevator and the perforation die positioned over the elevator;

Figure 5 is a top perspective view of a sealing head and perforation die positioned above the web of flexible film, with the sealing head positioned over the elevator and the perforation die positioned to the side of the elevator;

Figure 6 is a side perspective view of the apparatus of Figure 1;

Figure 6A is a front plan view of the apparatus of Figure 1;

Figure 6B is a front perspective view of a computer used to control the apparatus of Figure 1;

Figure 7 is a front plan view of a bag manufactured using the present invention;

Figure 8 is a side cutaway view of the bag of Figure 7;

Figure 9 is a front perspective view of the preferred embodiment of the reclosable fastener zipper strip of the present invention showing the fastener profiles of the first and second reclosable fastener zipper strip;

Figure 10 is a front perspective view of the reclosable fastener zipper strip of Figure 9 showing a series of interconnected reclosable fastener zipper strip sections having splotch sections between each section; and

Figure 11 is a front perspective view of a zipper tape application device applying the reclosable fastener zipper strip to a web of flexible material that is subsequently wound on a winder for later use in a bagging machine.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of inventive apparatus 120 (best shown in Figures 1, 6 and 11) is capable of accurately sealing a multi-purpose reclosable zipper strip 100 to a flexible material web 110 in an airtight manner. Moreover, apparatus 120 is capable of repeatedly performing the steps necessary to seal the multi-purpose reclosable zipper strip 100 to the flexible material web 110 while providing high manufacturing throughout and low cycle times.

The multi-purpose reclosable zipper strip 100 is preferably constructed of polyethylene and may include additives such as ethylene acetate to facilitate easy sealing. The flexible material web 100 is also preferably constructed of polyethylene, but may be constructed of other commonly known films, such as polypropylene or polyethylene terephthalate (Saran®), or any other material providing a sealing layer that is compatible with the multi-purpose reclosable zipper strip 100.

As shown in Figure 9, the multi-purpose reclosable zipper strip 100 comprises (1) a continuous supply of first profile strip 100A; and (2) a continuous supply of second profile strip 100C opposite the first profile strip 100A. The first profile strip 100A includes at least one rib 100B protruding from and along the length of the inner surface of first profile strip 100A. The second profile strip 100C includes at least two ribs 100D and 100E for sealably receiving rib 100B. Ribs 100D and 100E protrude from and along the length of the inner surface of second profile strip 100C. As shown in Figure 10, a series of splotch seal portions 100F are fused along desired lengths of the first profile strip 100A, the second profile strip 100C, and ribs 100B, 100D and 100E (shown in Figure 9).

As seen in Figures 6 and 6A, the multi-purpose reclosable zipper strip 100 is stored on fastener supply roll 130, from which it is fed through apparatus 120 by a servometer 140, which controls the acceleration, speed and deceleration of the multi-purpose reclosable zipper strip 100's movement through apparatus 120. The multi-purpose reclosable zipper strip 100 is wound through a series of dancer rollers 150 on dancer arm 160, which allows the multi-purpose reclosable zipper strip 100 to be fed into a feeding mechanism 170 at the desired tension as shown in Figure 2. In a preferred embodiment, as shown in Figure 11, a photosensor 162 reads the position of the dancer arm 160 and, when the dancer arm 160 is descended to a desired position, advances the multi-purpose reclosable zipper strip 100 using a nip drive 166.

The feeding mechanism 170 utilizes an optical sensor 180 to detect the presence of the splotch seal portions 100F. The optical sensor 180 detects the thickness of the multi-purpose reclosable zipper strip 100 and is thus able to detect and distinguish each splotch seal portion 100F because such portions are thinner than the remainder of the multi-purpose reclosable zipper strip 100. The splotch seal portions 100F thus act as eye marks to indicate the position of the multi-purpose reclosable zipper strip 100. In the preferred embodiment, the optical sensor 180 utilizes a piezoelectric bridge to convert changes in opacity of the multi-purpose reclosable zipper strip 100 at the thinned portions (splotch seal sections 100F) to an electrical signal to advance the multi-purpose reclosable zipper strip 100 a desired length.

When optical sensor 180 detects one of the splotch seal portions 100F of the multi-purpose reclosable zipper strip 100, it signals belt tracks 340 and 350 (see Figures 2 and 3), which utilize belt drive 360 to advance a desired length of the multi-purpose reclosable zipper strip 100 over elevator 230. Guillotine knife 370, driven by another servomotor 410, is then signaled to descend and cut selected portion 420 of the multi-purpose reclosable zipper strip 100. Section 420 of the multi-purpose reclosable zipper strip 100 is thus positioned over and deposited onto elevator 230. Both the operation of belt drive 360 and guillotine knife 370 can be

sequenced using pneumatic control devices such as those manufactured by Matrix Technologies or by utilizing a computer control system such as those manufactured by Allen Bradley.

As shown in Figure 3, in a preferred embodiment, the top surface of elevator 230 comprises a rectangular platform 240 for receiving section 420 of the multi-purpose reclosable zipper strip 100. As the selected portion 420 of the multi-purpose reclosable zipper strip 100 is being positioned and deposited onto platform 240 in the foregoing manner, the flexible material web 110 is being positioned above platform 240 as shown in Figure 4. A series of eye marks is printed along one edge of the flexible material web 110 and is detected by a second optical sensor 190 shown in Figure 5. The flexible material web 110 is advanced through apparatus 120 by a series of roll drivers 200, 202 (shown in Figures 2 and 11), which are driven by a second servomotor 210 shown in Figure 5. The speed of roll drivers 200, 202 is coordinated by the optical sensor 190 and a computer 220 (shown in Figure 6B), so that a desired portion of the flexible material web 110 is positioned over elevator 230 to receive the selected portion 420 of the multi-purpose reclosable zipper strip 100.

In one embodiment, the multi-purpose reclosable zipper strip 100 is mounted on a roller spool 130 (see Figure 6). As the multi-purpose reclosable zipper strip 100 is pulled through a series of dancer rollers 150 (Figure 11) mounted on dancer arm 160, roll drivers 200 pull the multi-purpose reclosable zipper strip 100 therethrough. When additional multi-purpose reclosable zipper strip 100 is pulled through dancer rollers 150, the upstream dancer arm 160 rises, causing coils 522 in springs 524 to stretch under tension (Figure 6A). When the dancer arm 160 reaches a preset position, the dancer arm 150 returns to an initial lower position. The coils 522 under tension pull the dancer arm 160 down to receive the multi-purpose reclosable zipper strip 100 being advanced through the three-loop dancer roll assembly 150 and the process is then repeated.

As shown in Figure 3 according to one embodiment, elevator 230 is contained within a hollow Lexan® pedestal 242 defining a central opening 244 in which the platform 240 is positioned. As shown in Figures 4 and 5, a pair of rectangular ledges 248 and 249 are located at the top of the pedestal 242. When the selected portion of the flexible material 110 is fed into position over the platform 240, the selected portion of the flexible material 110 extends over and between the pair of rectangular ledges 248 and 249.

As shown in Figures 4 and 5, a pneumatically controlled sealing head 270 is mounted on block 280, which in turn is slidably mounted on shaft 291. As shown in Figure 4, sealing head 270 and block 280 are positioned above the pair of rectangular ledges 248 and 249 and to the side of platform 240. Following the deposit of section 420 of the multi-purpose reclosable zipper strip 100 onto platform 240 and the positioning of

the flexible material web 110 above the platform 240, the block 280 is driven horizontally by an air cylinder 320 until the sealing head 270 is positioned above platform 240 and, preferably, in contact with the flexible material web 110. Sealing head 270, which is preferably Teflon® coated, is then either heated to the desired sealing temperature or maintained at the desired sealing temperature.

At the same time, elevator 230 is driven upwardly by shaft 400 until platform 240 (and the zipper tape portion 420 thereon) is in contact with the flexible material web 110. The heat passing through the flexible material web 110 from the sealing head 270 is sufficient to seal the peripheral portions of zipper tape portion 420 of the multi-purpose reclosable zipper strip 100 (as seen in Figure 10) to the flexible material web 110, thereby sealing the zipper tape portion 420 positioned on the rectangular platform 240 to the flexible material web 110 to create a fastener attached material web 112. Sealing head 270 further aids in creating the seal, as shown in Figure 7, by providing a stable surface against which the elevator 230 can compress the flexible material web 110 and the zipper tape portion 420.

The resulting seal 44 is airtight due to the construction of the multi-purpose reclosable zipper strip 100, which has thickened flanges 30 (shown in Figure 7) that melt and fill any gaps during sealing to further form the seal. Section 420 of the multi-purpose reclosable zipper strip 100 is also airtight throughout the zipper portions because of the unique construction of the zippers themselves, as disclosed in parent U.S. Patent Application Serial No. 09/415,696, incorporated herein by reference.

In one embodiment, a pneumatically controlled perforation knife 260 is mounted to block 280. When air cylinder 320 is actuated, perforation knife 260 descends downwardly so that perforation knife 260 perforates flexible material web 110 between the pair of rectangular ledges 248 and 249, which serve as an anvil against which the flexible material web 110 is severed by the perforation knife 260. The air cylinder 320 then retracts the perforation knife 260. In a preferred embodiment, sealing head 270 and perforation knife 260 may be combined so that the perforation of the flexible material web 110 and the sealing of zipper tape portion 420 may be accomplished simultaneously. Alternatively, the sealing head 270 can be moved into place over platform 240 after the flexible material web 110 has been severed by perforation knife 260. In another embodiment, fastener attached material web 112 is not perforated, but is fed and wound onto a winder 580 to create a zippered roll stock 590 with the multi-purpose reclosable zipper strip 100 already sealed on the flexible material web 110 for later use in a bagging machine 510 (see Figure 11).

While the present invention has been disclosed in terms of the preferred embodiments in order to facilitate better understanding of the invention, it should be appreciated that the

invention can be embodied in various ways without departing from its basic principles. Therefore, the invention should be understood to include all possible embodiments and modifications that do not depart from the invention as set out in the appended claims.